the capacitor

CDE

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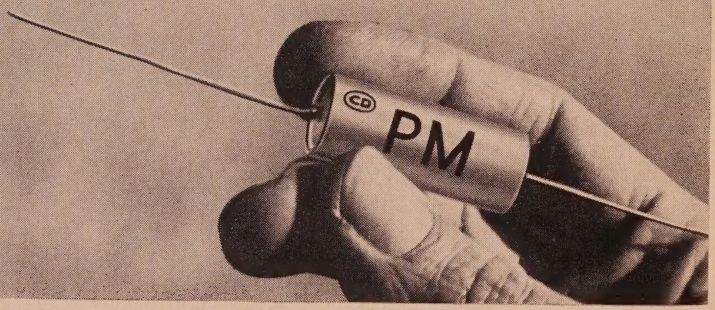

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ELECTRONIC TIME - INTERVAL MEASUREMENT

The measurement of time intervals and duration of phenomena has become increasingly important in modern electronic testing and experimentation. Whereas determinations of frequency, repetition rate, and phase angle were once entirely adequate, direct indications of time in seconds, milliseconds, microseconds, and millimicroseconds now often are demanded. Some of the items which are of importance to the engineer and technician are opening and closing time of relays; rise, fall, delay, and storage times of switching transistors; rise and fall times of nonsinusoidal waves; recovery time of switching diodes; and duration of pulses.

When the method of indicating time is direct and automatic, the possibility of human error is minimized. However, the need for calculations cannot be avoided in every instance. Several methods are available. The one chosen for a particular job will depend upon which instruments are available to the operator. This article describes methods of determining time intervals of electrical phenomena, or of nonelectrical phenomena which may be converted into electrical signals. This discussion does not exhaust the possibilities, but aims to survey the principal techniques.

Calibrated Oscilloscope

High-grade laboratory oscilloscopes are provided with time-calibrated horizontal sweeps. The panel controls are graduated directly in time ranges (such as milliseconds per centimeter). This permits time values to be read directly from the horizontal axis of the screen. Thus, the operator simply measures the width of a displayed pulse or wave, in centimeters or scale divisions, and multiplies by the factor indicated by the control. (For example, when the pulse is 10 screen divisions wide and the sweep is 10 microseconds per division, the pulse duration is 10 x 10 = 100 μsec.)

This perhaps is the most convenient method of time-interval measurement. But its accuracy depends upon close control and stability of the sweep frequency and accurate calibration of the horizontal axis. Linearity of the sweep and the horizontal channel also must be excellent. For these reasons, time calibration is available only in higher-priced oscilloscopes. The direct time-calibration of conventional oscilloscopes ranges from several millimicroseconds per centimeter in high-speed research models to several seconds for 4 inches of screen deflection in some some low-frequency models.

Any oscilloscope may be time-calibrated by the operator in the following manner. (1) Determine the frequency (f) of the internal sweep at all settings of the coarse and fine sweep controls. This may be done through use of an accurate signal generator (supplying the vertical input signal) and adjusting the generator for a single, stationary signal-cycle on the screen. At this point, the sweep frequency (f) then is read from the generator dial. The sweep time $t = 1/f$, where t is in seconds and f in cycles per second. This must be repeated at all settings of the coarse and fine sweep controls. (2) Apply the pulse or wave of interest to the vertical input, and adjust the sweep for a single, stationary cycle or pulse. (3) Read the time duration from the sweep calibration made in Step 1. The accuracy of this scheme depends upon the frequency accuracy of the calibrating signal generator, sweep stability and linearity, horizontal channel linearity, and freedom from interaction between vertical gain, horizontal gain, and sync adjustments on the sweep frequency.

Timing Waves

A timing wave of accurately-known frequency may be displayed below the phenomenon under study on the oscilloscope screen, as shown in Figure 1, and the duration of the phenomenon determined by counting the number of timing cycles between the beginning and end of the phenomenon. The time interval (duration) $t = 1/f$, where t is in seconds, and f in cycles per second. For accuracy, the timing frequency should be selected high enough to give as many cycles as practicable in the width of the phenomenon under study.

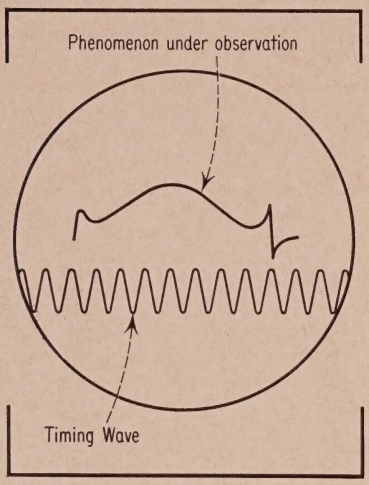

Fig. 1. Use of Timing Wave.

This technique may be employed easily with a dual-beam oscilloscope or with a conventional oscilloscope combined with an electronic switch to handle the two signals. If the phenomenon is transient, the screen display should be photographed. If an electronic switch is not available, a double exposure may be made from the screen of a conventional oscilloscope — first for the phenomenon and second for the timing wave.

Some operators prefer to adjust the controls of the oscilloscope or electronic switch to superimpose the two signals for somewhat easier comparison. This is permissible but there sometimes is a confusion of lines when the phenomenon produces an irregular pattern.

A timing wave may be employed also in the use of a recorder or oscillograph. Conventional recorders are direct-inking on paper which passes under the signal-actuated pens, from a roll. Oscillographs usually give luminous traces which are recorded photographically on a moving roll of sensitized paper or film. With either instrument, the signal under study is presented to one channel, and the timing wave to the other. Time-interval measurements then are made in the same manner previously described for the oscilloscope. Recorders and oscillographs are restricted to relatively low-frequency phenomena, because of the mechanical inertia of the galvanometer elements which move the pens or light beams.

Reference to Chart Speed

In the recorder or oscillograph, the film or paper is moved by an adjustable-speed motor (sometimes by clockwork). The speed at which the paper moves is indicated in feet, inches, or centimeters per second. Therefore the horizontal axis of the recording provides a simple means for measurement of time intervals.

Figure 2 shows a section of record chart from such an instrument. Here, the length, d, of the input trace is measured and the time interval deter-

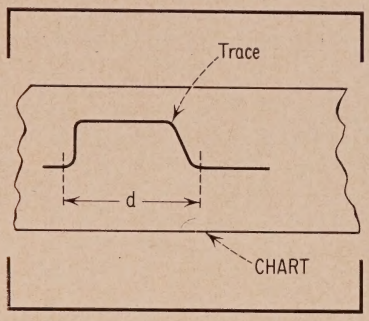

Fig. 2. Use of Chart Speed.

mined from d, and the speed: t=dS, where t is the time in seconds, d the length of the trace in appropriate units, and S the paper (film) speed in units per second. Thus, where the paper speed is 10 inches per second and d is measured as ½ inch, t=0.5(10)= 5 seconds.

This technique is particularly convenient when the recorder or oscillograph has only one input channel, therefore no provision for plotting a timing wave.

Production of Timing Pulses

Some operators prefer, instead of the sinusoidal timing wave shown in Figure 1, a series of narrow pulses. In some instances, accuracy is improved by the sharp points of such pulses. Figure 3 shows how a string of pulses may be used to determine time intervals along the horizontal axis of an oscilloscope screen. Recorders and oscillographs, being electromechanical in nature, do not usually handle fast pulses very well. Because of its characteristic shape, the timing-pulse string has been termed a **comb** and the pulses its teeth. To determine a time interval, align the patterns so that a tooth of the comb marks the beginning of the signal trace. Then, starting with this tooth, count the number (n) of teeth between the beginning and end of the signal trace, and calculate the time interval: t=(n-1)f, where t is the time in seconds, and f the repetition rate (number of pulses, or teeth, per second).

There are numerous ways of producing sharp spikes for timing purposes. A professional pulse generator will supply spikes over a wide frequency range. Figure 4 shows two of the less complex schemes. In Figure 4 (A), a square wave input signal is applied to the differentiator which consists of C and R_1 in series. When

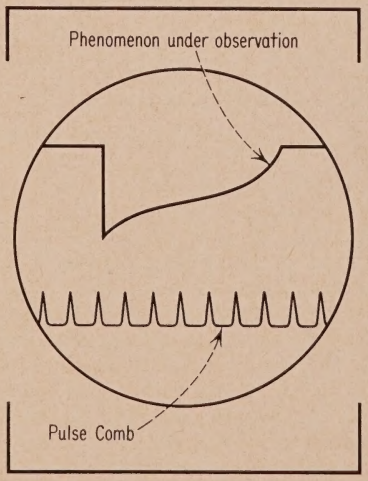

Fig. 3. Use of Timing Pulses.

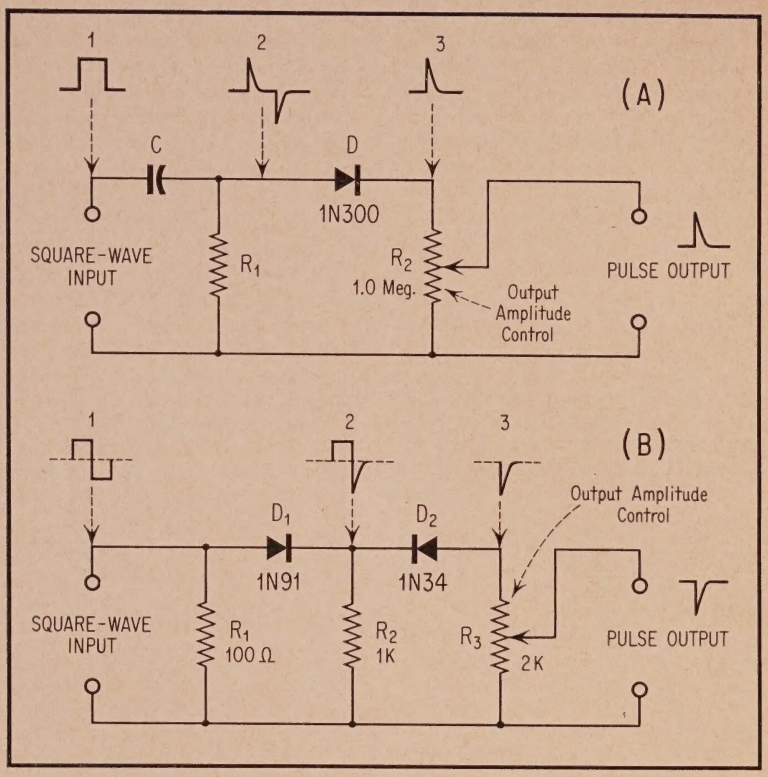

Fig. 4. Timing Pulse Circuits.

the CR_1 time constant is as low as 10/f (where f is the square wave frequency), the voltage developed across R_1 has the shape shown in Pattern 2. Diode D removes the negative spike from this voltage and transmits the positive spike (pattern 3). Since the output control resistance, R_2, must be much higher than R_1 to prevent overloading the latter, the inverse resistance of the diode must be extremely high, otherwise rectification will not be possible. Hence, Diode D is a silicon unit.

The differentiator is frequency-sensitive. If spikes are desired over a wide frequency range, the values of C and R_1 must be changed often. Because this sometimes is inconvenient, another circuit which is not susceptible to frequency is given in Figure 4(B). This arrangement utilizes the recovery time (hole storage effect) of a germanium power rectifier, D_1. [1] The input square wave is applied to D_1. During the positive half-cycle, forward current flows through D_1 and R_2, as in-

dicated by the upper portion of Pattern 2, and holes are injected into the germanium junction. When the square wave switches to its negative half-cycle, hole storage prevents D_1 from switching instantaneously to its high inverse resistance. The result is that a sudden pulse of high inverse current flows through D_1 and R_2, as indicated by the lower half of Pattern 2. The voltage across R_2 has the same spiked shape and is applied to the conventional 1N34 diode, D_2, which passes the negative spike but holds back the positive voltage. The result is the spike shown in Pattern 3. If the square wave generator has an internal low-resistance path between its output terminals, Resistor R_1 will not be required. The number of pulses in the timing comb varies directly with the square wave frequency.

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[1]Rufus P. Turner, "Wide-Range Spike Generator," **Radio & TV News**, May 1956, p. 111.

Setting Time Intervals

Very often, it is desirable to set time intervals automatically by electronic means, rather than measure time. The equipment for accomplish-

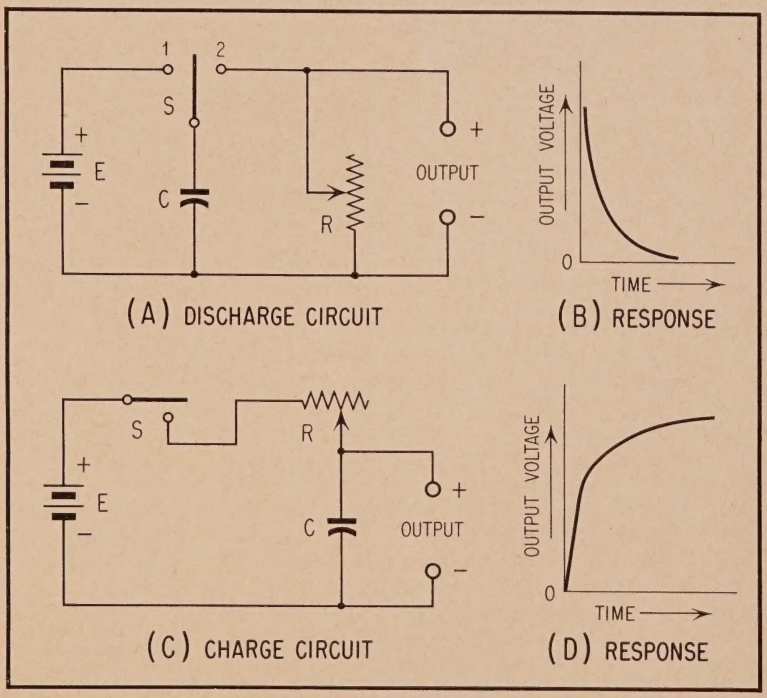


Fig. 5. R-C Timing Circuits.

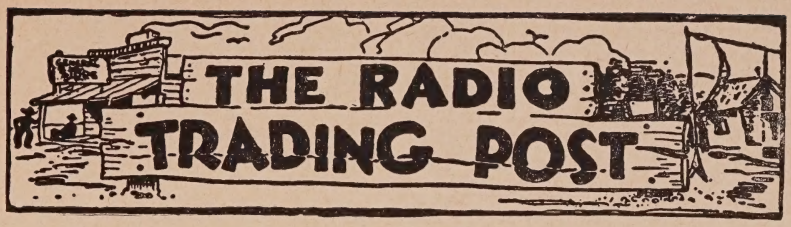
ing this is sometimes very complicated but the basis of its operation usually is the time constant of a resistance-capacitance circuit. Figure 5 shows R-C timing circuits.

In Figure 5(A), Switch S first is thrown to its Position 1. This connects Capacitor C to the battery and causes it to charge to the supply voltage, E. Next, S is thrown to Position 2. The capacitor now discharges through Resistor R, the discharge current being initially high and then decreasing exponentially with time. The voltage at the OUTPUT terminals follows the same decay. (See Figure 5B.) The time constant of the circuit is $t = RC$; where t is the time (seconds) for the discharge current (and the voltage at the OUTPUT terminals) to fall to 37% of its initial value, R is the resistance (ohms), and C the capacitance (farads). By making R variable, the time interval may be varied. R may be replaced with the coil of a sensitive d-c relay which is picked up by the initial current and dropped out at a predetermined instant governed by Capacitance C and the resistance of the relay coil. Or the output voltage may be presented to a d-c amplifier for operating a heavy-duty relay, alarm, recorder, or other device.

In Figure 5(C), when Switch S is closed, Capacitor C charges through Resistor R. The current initially is high but decreases exponentially with time. The capacitor voltage increases exponentially until it eventually equals the supply voltage, E. (See Figure 5D.) The time constant of this circuit is $t = RC$; where t is the time (seconds) for the capacitor voltage to reach 63% of its final value, R is the resistance (ohms), and C the capacitance (farads). By making R variable, the time interval may be varied. The d-c output of this type of circuit is presented to the input of a very-high-resistance d-c amplifier for operating a relay, alarm, recorder, or other device.

FREQUENCY	PERIOD
20 cps	50 msec
40	25
50	20
60	16.7
100	10
120	8.3
150	6.7
200	5
250	4
400	2.5
500	2
1000	1
10,000	100 μsec
50 kc	20
100	10
500	2
1 Mc	1
10	100 mμsec

Table 1. Periods Corresponding To Common Frequencies.



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WANTED — Schematic of Superior 1260 VTVM & dynarometer test cable. Will also buy the test cable if available. John Gaylord, 506 Garfield Ave., Scottdale, Pennsylvania.

WANTED — Military tech. manuals, surplus test equip, instruments, klystron tubes, Hewlett-Packard, General-Radio and other lab equip. Engineering Associates, 434 Patterson Rd., Dayton 19, Ohio.

WANTED — FM tuners, AM-FM radios. Give make, model, and best fob price. Also want Hallicrafters S-81, Civil Patrol receivers. Mercury Radio, 433 So. Wabash Ave., Chicago 5, Ill.

FOR SALE — Radio books, electrical, other tech items, projector, printomatic machine 2A, tubes, records. Want fireman antiques, auto items, badges, old CW items. H. Kuell, 138 Clinton Ave., Newark, N. J.

FOR SALE — Roberts stereo tape recorder $250, Heathkit SP2A stereo preamp, $60, Recordio home disc recorder, $65, U.T.C. isolation transformer 100w, $9, and tape lube kit, $2, 12" Danish co-axial speaker $7. John H. Wiedenheft, 72 Sherman St., Hartford 5, Conn.

FOR SALE — German made portable precision output meter, 5 scales to 150v $15. Superior 77V VTVM with case and manuals $35. Like new, Superior genometer TV-50 signal generator complete $35. ATR Elia 6v battery eliminator with built-in ammeter, very good condition $15. Albert C. Hart, 207 N. Raymond St., Griffith, Ind.

SELL OR TRADE — Like new Tork 7D1191 single pole, single throw, 35 amp. time switch, and two Minneapolis-Honeywell TA42A heavy duty single pole, single throw thermostats. Want M-H electric clock thermostat including clock transformer. D. Kurs, 775 Plympton St., New Milford, N. J.

FOR SALE — Precision test gear: Weston models 1, 433, 785, 779, 301, General Radio 636-A, 222S, 1217A, 434B; Hewlett-Packard 200CR, 200CD, 400A, 410A, Dumont 241, 224A, 208, 175A. Send for detail listing. Emil Backstrom Jr., 303 Hornidge Rd., Mamaroneck, N. Y.

FOR SALE — 50w 5 band Babcock MT5B mobile xmtr $70; Morrow 5BR2 converter $40. Both 80 thru 10 meters, 6/12v. Will ship pp. Frank Schuch, 10101 S. Albany Ave., Evergreen Park 42, Ill.

FOR SALE — Ampkit 20w complete except speaker, RCP 668 electronic Multitester VTVM and cables, Heath V4A VTVM assembled with cables. Robson & Burgess M-700 multitester, TV20 tube tester. All like new. Single unit $20, all for $50. August Palermo, 901 North Micheltorena St., Los Angeles 26, Calif.

WANTED — Fine Hi-Fi equip, sailing ship models, jade items. Have sapphire, opal and diamond stones, Bolex 8mm camera and B & H projector. Write for information. J. J. Custer, 4455 Kissena Blvd., Flushing 55, N. Y.

WANTED — D396 Viking portable case to accept 85 series tape deck and RP62 record playback preamplifier or model 400 consolette and model 401 RP62 enclosure. Thomas Bradford, 427 Beach 89 St., Arverne 92, N. Y.

FOR SALE — Precision: TV voltmeter, MA meter, ohmmeter, AC & DC Multimaster series EV10, E-200C sig. gen., E-400 sweep gen. All like new & for best pr. Al Kafoury, Highway 82 W. & Clay St., Greenville, Miss.

FOR SALE — Electronics, Proc. IRE, Proc. AIEE, convention records & electronic books & computer books, radio parts. Write for list. H. Cobb, Box 552, Orange, California.

WANTED — 2 meter or 6 meter walkie talkie, Single set or pair. Prefer local deal. P. Ludwig, 16-21 — 212 St., Bayside 60, New York.

FOR SALE — BC-221AK Freq. Mtr., modulated, with calib. book and AC power supply in compact metal cabinet, $100. Gould, 281 S. Castanya, Menlo Park, Calif.

WANTED — TM-11-866 for BC-779B. Will pay cash. Martin D. Johnson, Alliance, Neb.

WANTED — To correspond with Stereo tape recorder owners. Object: interchange of tapes, etc. Two or four track. C. M. Metze, 501 Fifteenth St., Levelland, Texas.

FOR SALE — 435 Sams Photofacts, good cond. many never used, $550. Eugene Smith, Box 81, Hydro, Okla.

WANTED — Hickok 760-660-630-615-292X-288X; RCA WR46A, WR39A. WR61B, 162C; Weston TV sweep gen., marker gen., scope. Antonio DiStasio, 3492 Kingsland Ave., Bronx 69, N. Y.

SWAP — Regency ATC-1 transistor ham band converter for CB Transceiver, superhet type only, for FM tuner. Morris Goodman, 2621 Burns Pl., Union, N. J.

FOR SALE — Hallicrafters S-107 like new, must sell quick. Jackie Dempsey, 23799 Cornwall Rd., West Lake, Ohio.

WANTED — UHF converters, in working cond., and with tubes. F. & F. Radio & TV Service, Box 239, Bullhead City, Ariz.

FOR SALE — Three WE-4168's, $8 each. Jared Wolf, Box 127, Concordville, Pa.

TRADE — Sico 670A VOM and TV parts, wire recorder mechanism, for saddle blanket and saddle. Art Lowe, Farmersburg, Ind.

FOR SALE — RCA kilowatt transmitter, completely guaranteed, $250; CDR rotor AR-22, slightly used. $35; parts, for cash or trade for old firearms. Dick Brand, Rt. 1. Box 179, Scottsbluff, Neb.

SWAP OR SELL — Record players and recorders, also parts, wire recorder, cameras, mimeo, projectors, TV tuners, printer's type, etc. Cabon, 804 N. Kingsley Dr., Los Angeles 29, Calif.

FOR SALE — 640B trans. 100-156 Mc., 7 units in rack; RE 47 comm. hi-voltage for ART-13; RA2A rect., 24 v., 10 amp. comm. unit for ART-13 RA2D receiver. Make offer. M. J. Douglas, 1401 Amador, Concord, Calif.

WANTED — Hi-voltage transformer 110 v. - 220 v., 3000 volt at 500 ma. Could use higher voltage. Have all sorts of gear to swap, or will pay cash. A Gelfon, 217 W. Main St., Stamford, Conn.

FOR SALE — GE Portable 250 and 260 radios, $10 each less battery or trade for what have you. M. S. Blemley, 23710 Samoset Trail, Southfield, Mich.

FOR SALE — Two Vocaline 465 Mc. Citizens Band transceivers, like new, $50, or $35 each. W. C. Gutermuth, 807 Mechanic St., Jeffersonville, Ind.

WANTED — Sockets and chimneys for 4X-150A's KW final RF or parts for same. Cash or trade test equip. Gil Howarth, 216 1st Ave. E., Oskaloosa, Iowa.

FOR SALE — ART-13 mechanical parts; Autotune mechanisms; major electrical components; subchassis, and small parts. John W. Cale, Norwood, Mo.

WANT — 12 volt FM car radio or car transistor portable in exchange for voltage booster and $25. Will pay freight both ways. Burt Kaufman, Box 252, Boston 35, Mass.

TRADE — HQ-110 for HQ-140 or equivalent. Paul Gawenus, RD 1, Port Jervis, N. Y.

FOR SALE — Code machine 10 tapes, AC osc. with spring-wound motor, $18; wireless intercom, $8; 2 sound pwrd fones, $6; Midwest 5 band AM-FM radio KD16, like new, $60; 10 watt amp., $15; 25 watt amp., $25. J. Eastwood, 868 Center Dr., Franklin Square, L. I., N. Y.

FOR SALE — Hallicrafters SX-100, $185; R46B speaker, $10, in good condition. John R. Ottinger, 814 - 62 St., Brooklyn, N. Y.

WANTED — Schematic or information for Aireon 1221A amplifier, mfd. in Kansas City. B. Serota, 2502 S. Phillips St., Philadelphia 48, Pa.

FOR SALE — Sylvania 216 FM-AM signal generator; Superior 76 CR bridge and signal tracer; C-D BF-80 flyback and yoke checker. All like new. Make offer. Frank Mordini, Highwood, Ill.

WANT — Used Hallicrafters SX99 or Heath DX40. Lyal Bauer, Rt. 1, Jessup, Iowa.

FOR SALE — Riders Radio manuals, 1 thru 22, $3 each; Supreme 1 thru 14, TV manuals 1 thru 6, TV servicing course, $1 each or will trade for Sam's Photofacts above No. 330. H. E. Clair, Box 174, New Baden, Ill.

WANTED — International remote control unit, or similar item, for changing channels on TV set. State condition and price. J. Hearn Hill, 1628 S. 11th St., Waco, Tex.

FOR SALE — Rider's Radio Troubleshooter manuals, Vols. 6-9, 40 other books on auto radios, record changers, etc. $100 FOB. F. J. McNulty, 50A Vernon St., Worcester 10, Mass.

FOR SALE — Sylvania 500 sweep signal generator, very good cond. Best offer over $50. RCA Radio correspondence course including kits, $50. No shipping. Charles Levine, 158 - 39 Jewel Ave., Flushing 65, N. Y.

FOR SALE — Sams Photofacts: sets Nos. 3, 13, 17, 49, 73, 79, 108, 111, 113, 123 thru 130, 133 thru 156 etc. Send for list. Walter E. Dietz, 37535 N. 5th St. East, Palmdale, Calif.

FOR SALE — Sencor leakage checker 2-C-2, $15; EMC Tube Ohm capacity checker 202, $25; Century picture tube checker 102, $5. Need good in-circuit capacity checker. E. C. Spotter, 224-16 144th Ave., Springfield Gardens, 13, N. Y.

SELL OR SWAP — For electronic equip., or what have you? Hand and power tools, tubes, transformers, electric AC motors, electric fans, etc. Thomas F. Elwood, 22 Butler Place, Rosebank, Staten Island 5, N. Y.

SELL OR TRADE — No kits. Superior Meter VOM, model 670, for Eico VOM Model 555. Sanford Warm, 63-53 Haring St., Rego Park 74, N. Y.

SWAP — NRI Transmitting Course, complete with kits, 7 years old, for tape recorder. M. Dalkiewicz, 184 Outwater Lane, Garfield, N. J.

SELL OR SWAP — $365 Illustrating and Cartooning course by Art Instruction, Inc. Interested in Sams Photofacts and TV test equip. Charles D. Stewart, 2530 Cedar Ave., Scranton 5, Pa.

WANTED — Variacs in damaged, burned-out or shorted condition. State price. Stanley Zuchora, 2748 Meade St., Detroit 12, Mich.

TRADE — 7x35 binoculars or transistor radio, for a scope. Could be a part of assembled kit. Lou Gunshor, 3820 Lyme Ave., Brooklyn 24, N. Y.

WANTED — Instruction manual for McMurdo-Silver 904 Resistance-Capacitance checker. Have for sale TV boosters and UHF converters, all makes, reasonable prices. W. Williams, 914 S. Franklin St., South Bend 18, Ind.

WANTED In Working Condition — Dumont 256-D range scope; lab. test equip.; commercial power supplies; lab. type measuring and recording equip. of all kinds. State cond. and price. Arthur Casey, 11 Lovett Ave., Brockton, Mass.

FOR SALE — Hammarlund HQ-100C receiver with instruction manual, in very good cond; three table top radios, good for Conelrad in amateur stations. Best offer. R. Migliorino, 171 Wagaraw Rd., Hawthorne, N. J.

FOR SALE — UHF converters, RCA, Crosley, etc., $5 each. Want diagram for Supreme 504B tester. M. J. Rebennack, 5632 Canal Blvd., New Orleans, La.

WANT — Heathkit LP-2 linearity pattern generator, need not be in working condition, but must have all parts. P. F. Bahr, 1013 Indiana St. SE, Albuquerque, N. Mex.

SWAP — TV test instruments for small radios, clock radios, 17" & 21" TV sets, Riders, Sams. Metropolitan area only. John Rosol, 612 So. 11th St., Newark, N. J.

FOR SALE — Goldak 599 Locator in top shape with batteries, $65; crude organ osc. keyboard, working with tube, $12; early Dicto-Grand radio speaker, horn type, $15, all FOB. W. R. Lake, Piqua, Ohio.

TRADE — Tubes for stereo tapes and stereo amp. Gregory H. Swiska, 109 E. School St., Woonsocket, R. I.

FOR SALE — Convertor for UHF-TV, like new, $5. Want convertor for auto-radio to marine band; small std. marine radiotelephone. Decker Smith, 5103 Birkenhead Rd., Jacksonville 10, Fla.

WANT — 2 Citizens Band transceivers for about $25 each. Roger W. Kern, Spring Brook, Wis.

SWAP — Old 201-A, 301-A, 26, 45 and 71-A tubes for more recent tubes, Hi-Fi, or ham gear. Bud Hartman, 80 Pickering St., Danvers, Mass.

FOR SALE — Heath AR-3 with cabinet, $30; FM-3A tuner, factory aligned, $20; QF-1 Multiplier, unused, $7; H. H. Scott 99 amplifier with matched Mullard output tubes, $85. John A. Hughes, 3647 Polley Dr., Youngstown 9, Ohio.

FOR SALE — Garrard DC to AC converter, 500 watts continuous duty; T3 Astatic with push-to-talk stand; 110 DC, 110 AC, 24 v. DC 6 v. DC heavy duty relays. E. B. Schofield, Box 14, Jarrettown, Pa.

FOR SALE — Electronic and TV parts and equipment. Cheap. Send stamp for list. Ace TV, 5341 Cordelia Ave., Baltimore 15, Md.

WANTED — Short-Wave Radio magazine, Oct. 1934 issue. Advise condition and price. Silom Horwitz, 1311 Strafford Rd., Camp Hill, Pa.

SELL OR TRADE — 6 volt Sonar 2 meter mobile receiver (MR-3) without B supply, $15 or trade for Gonset 2 meter converter. R. W. Christen, 2443 E. 22 St., Brooklyn 35, N. Y.

SELL OR SWAP — QST's from 1946 to date; CQ's 1954-1959; Radio-Electronic 1949 to date. All like new. Make offer for lot or part. Al Labowitch, 1519 Liberty Ave., Hillside, N. J.

FOR SALE — Riders manuals, 1 thru 15, $15; 10 tube RCA AM-FM chassis with 10" spkr., needs antenna, $15 FOB. M. A. Porter, 4930 N. Pulaski Rd., Chicago 30, Ill.

SELL OR TRADE — TV sets, group of 10, only $100. These are trade-ins, sold as is. Hillcrest TV Servicenter, RFD 2, East Chatham, N. Y.

WANTED — Test equipment for 2-way radio servicing, also aircraft radio test equip. State price and condition. Floyd L. Kelley, 2021 Camellia Dr., Bastrop, La.

FOR SALE — Hickok 690 marker gen., Hickok 695 sweep gen. Both units like new in original boxes, $200 each. M. Wiener, 2551 N. Jerusalem Rd., East Meadow, L. I.

FOR SALE — Heath OM-2 oscilloscope 5", like new, $35. Local preferred. Richard A. Holt, 60 Inwood St., Yonkers, N. Y.

FOR SALE — Hallicrafters SX-100 and R-48 speaker, like new, $225 cash, no trades. C. Wegrzynowski, 51 North Central St., Buffalo 12, N. Y.

FOR SALE — Riders manuals with master index, manuals 1 thru 14; Riders Servicing Record Changers and Recorders; RCA Picto Guides 1, 2, 3. Make offer. R. I. Beale, 6645 SW 73 Ct., Miami 43, Fla.

WANTED — Jensen RP-302 UHF tweeter; Stereo AM-FM tuner; Hi-Fi stereo LP records, preferably jazz, popular or show tunes, for cash or have equipment and parts to swap. L. Buddine, 1700 W. High St., Haddon Heights, N. J.

FOR SALE — Transistorized audio freq. meter 0-100 Kc., $35; transis. grid-dip meter, 400 Kc. to 100 Mc., $30; misc. power supplies, transformers, rectifiers. Send requirements. Bourchan R&D, 127 Great East Neck Rd., Babylon, N. Y.

WANTED — Radio tubes, magnetrons, klystrons, power tubes, and microwave test equip. A. Platner, 112 Crosby St., New York 12, N. Y.

SWAP — Radio test equipment, for Welte Mignon player piano. Thomas F. Elwood, 22 Butler Pl., Staten Island 5, N. Y.

FOR SALE — GE meter, AEA200, 0-1 RF amps., 2½" round metal case, $5 postpaid. L. Wienreb, 151-09 34th Ave., Flushing 54, N. Y.

SELL OR TRADE — El-Tronics PR-5A geiger counter with batteries, headphone, radioactive source and instructions, 2½" meter, very good cond., $50, or for lab. chemicals or apparatus. James Maskasky, 225 Ludlow St., Long Branch, N. J.

SWAP — RCA Voltohmist Jr. Want 6' to 10' row boat or pram in good condition. Richard A. Newell, 78 Princeton Road, Fair Haven, N. J.

WANTED — BC-221 chassis only, in good condition for transmitter VFO. Do not need calibration book, crystal, tubes, or case. V. Barker, West Drive, North Haven, Sag Harbor, L. I., N. Y.

FOR SALE — Coynes 7-volume Radio-TV books, not soiled, $20; GD-1B oscil. Heathkit, professional wired, 250 Mc. to 350 Kc. coils, $20. Both plus postage. H. Hanrion, 2126 N. Cedar, Fresno 3, Calif.

WANTED — FM tuners and radios; tape recorders. Describe make, model, cond., and best price. Mercury Radio Service, 433 So. Wabash Ave., Chicago 5, Ill.

FOR SALE — Unused B&R TV Analyst 1075 in very good condition. A must for every trouble shooter. Jim Wyatt, Box 259, Lexington, Ky.

FOR SALE OR TRADE — Like new BC-645 transceiver; BC-454 receiver; T-17 mike dynamotors. Want radio TV magazines, books, manuals. Luther F. Aceves, Box 296, Omar, W. Va.

WANT — Amateur radio comm. receiver, single or dual conversion, with or without speaker; BC-799 or BC-799A with power unit. All in good working cond. State particulars and price. D. Landesberg, 179 Marcy Ave., Brooklyn 11, N. Y.

FOR SALE — 10 mfd. 600 v. oil rect., 10 for $5; 100 Jones Socket P-310AB, $9; power xformer. W. Kalmanson, 80 St. Marks Pl., Staten Island, N. Y.

SELL OR SWAP — RCA 140 short wave (needs some work), $10 and set of Lionel trains. Will swap both for small novice transceiver and pay difference, if any. Dennis Walsh, 493 Fresno Dr., Magnolia, N. J.

SELL OR SWAP — Fixed or mobile xmtr. Elmac A54 with dynamotor, whip ant.; Stancor Illuminator 6-12 v.; 1960 tape recorder with mike in carrying case. Want commercial SW receiver, xmtr., tube tester. John A. Berry, 5802 Master St., Philadelphia 31, Pa.

FOR SALE — Croname 530-32 Dial Drive Mechanism, 5 spring loaded gears, separate main and band spread dials, 100 to 1 ratio drive, in original box. Fine for receiver, VFO, frequency meter, $5. E. Peterson, 1590 E. 22 St., Brooklyn 10, N. Y.

FOR SALE — Well established Radio-TV Sales & Service business. Well stocked, well equipped. Excellent opportunity for younger man in fast growing area. T. H. Ellery, Box 2675, Marathon Shores, Fla.

WANTED — Simpson 480 Genescope. State condition and price. T. A. Milam, 1301 6th Ave. S.E., Decatur, Ala.

URGENTLY NEEDED — Schematic diagram for Browning Oscillosynchroscope model OL-23. Would like to buy or borrow. John Peppas, 113 Statesir Pl., Red Bank, N. J.

SWAP — Lettine antenna tuner for ARC-5 Command receiver covering 1.5 to 3.0 Mc. Robert Cobaugh, 29-29 213th St., Bayside 60, N. Y.

WANTED TO BUY — One each original tech manuals for surplus BC-348-O and BC-348-S receivers. Garnet W. Frank, Route 1, Potsdam, N. Y.

WANTED — Handle for Weller Electric Corp. WD 135 Weller Soldering Gun. State color and price. Jack L. Schwingel, 9 West Liberty St., Dansville, N. Y.

WANTED — Zenith PT-95-1298 power transformer in working order; record changer for Capehart 10W212M TV-phono-radio comb. Walter A. Koehler, 131 Stratford Dr., Houghton Lake 12, Mich.

FOR SALE — Complete BC-1306 with built-in VFO transceiver; PE-237 power supply with 6, 12 or 24 v. input; mobile 4450 Kc. whip with mount; push-to-talk mike; mobile rig 3800 to 6500 Kc. All in very good cond., $85 plus shipping. Meryle R. Hansen, Box 126, Ruthton, Minn.

FOR SALE — Kay Mega-Sweep and Kay Mega-Marker, $100; Rauland 35 w. PA amp., 3 University outdoor speakers with drivers, $100; Vomax and Eico VTVM's, $15 each; Paymaster Checkwriter, $55. Joseph Konecny, 1719 Sefa Circle E., Jacksonville 10, Fla.

WANTED — Electronic tubes, receiving, transmitting and special purpose. William Schechter, 141 Beach 125 St., Belle Harbor 94, L. I., N. Y.

WANTED — Old issues of QST. State dates of issues and price. Larry Mowrey, 2745 N. E. 34th St., Portland 12, Ore.

TRADE — KWS-1, 75A4 and control spkr., 6 element 20 meter beam, 50 ft. steel tower, for light plane of same value. H. Fletcher Bates, 349 Lincoln St., Hingham, Mass.

FOR SALE — A-1 heavy 78 rpm changer with record cutting arm with inductance type head, volume control, amplifier plugs. Amp. not furnished. Best offer. R. O. Bruner, R. 4, Terre Haute, Ind.

FOR SALE — Rek-O-Kut base for Rondine turntable, $3; Spot-O-Matic model 1 enlarging meter, $3; Clarkstan stylus pressure gage, $1; Simpson 324 multimeter with leads, $10. Jack Atkins, 1375 27th St., Ogden, Utah.

SELL OR SWAP — LaBelle 500W semi-auto slide proj. with 8 mag., remote control, $25; Sylvania 7" scope, $30; Eico VTVM, $12. Want Acro 60W amp. and MX-949 adapter for 1-177 tube tester. R. Lewis, 277 First St., Keyport, N. J.

FOR SALE — Hammarlund HQ-145C receiver, with instruction book and clock in very good condition, $175 postpaid. C. H. Campen, 1310 Montgomery Rd., Baltimore 27, Md.

FOR SALE — Complete ham station: HQ-120, DX-40, VF-1, 40 m. dipole, all aux. equip., wired for single switch operation. Complete inventory sent on request. Barry Goldstein, 91 Morris Dr., East Meadow, N. Y.

SELL OR SWAP — University 312 Triaxial Speaker, $50; Oak Ridge Syncrosweep bar gen., $15; Scott chrome plated AM-FM-SW tuner, $15; transistor phono amps. Need ham or test equip. Glen Barnett, Box 2805, Palm Springs, Calif.

FOR SALE — Hammarlund HQ-120 receiver with speaker, Viking Ranger xmitter with key; pair of tuned wave traps; coaxial relay, 110 v., in good condition, all for $300. Richard Pette, 151 Riveredge Rd., Tenafly, N. J.

FOR SALE — Hallicrafters S-108 comm. receiver, like new, in very good working condition, $90. Fred Tozier, 4415 Tyler St., Sioux City 8, Iowa.

FOR SALE — Heathkit TV alignment gen., TS-4A, $35; Knight sweep gen., for TV and FM, $35; Philco 8300A wideband amp. for scopes, $45. All FOB. John E. Yeager, 306 Amherst Ave., Reading, Pa.

WANTED — Precision E-200C, E-400, sine-square wave generator, must be A-1 condition. Have Bogen B-50 and Delco 986515 radio to sell or trade. Edward J. Kimmel, 2061 Eastern Pkwy., Louisville 4, Ky.

WANTED — CB transceiver (Heath GW-10D or Gonset G-12) or similar; Hickok 209A VTVM. State prices and condition. Terry A. McDonald, 2680 Tremainsville Rd., Toledo 13, Ohio.

WANTED — Swifty dry iron No. 1000 handle; back issues of PRD Reports; Radiotron Designers Handbook; Riders. Have books on auto repair, math, boats. Sidney Gross, 31 Marwood Road North, Port Washington, N. Y.

WANTED — Sonar SR-9 2 meter receiver and/or schematic for same. State cond., and price. Bruce E. Opdenbrouw, 506 Maple St., Bridgeport, Conn.

FOR SALE — Eico 232 VTVM, in very good working order, $30; University 6201 coax speaker, $41. John P. McCullen, 3050 Bainbridge Ave., Bronx 67, N. Y.

FOR SALE — Hallicrafters World-Wide receiver, dynamic tuner, 8 bands, $69; Hickok 610A universal TV-FM alignment sig. gen., $69; Kay Electric Co. Mega-Pix TV sig. gen., $39. Diags. and instruction book incl. Peter Mumola, 309 W. 19 St., New York 11, N. Y.

WANTED — Audio mixer, tape recorder (Ampex), remote amplifier, AM-FM tuner, small transmitter. early crystal set, Hi-Fi gear, Exacta 35mm camera. James H. Lowe, 1521 Scenic Dr., Pasadena, Calif.

WANTED — B&K 1075 analyst. State lowest cash price and condition. Minewiser's TV, 6801 4th St. No., St. Petersburg, Fla.

FOR SALE — Sams, 87 thru 450, $360; Riders 8 thru 20, $50, or all for $400. Carl Kroninger, 123 State St., Seneca Falls, N. Y.

FOR SALE — I-222-A sig. gen., 8-15 and 150-230 Mc., $25; 150 Mc. 2-way FM units, cheap; old tubes. Experimental Research Lab., 62 Broad St., Albany 2, N. Y.

WANTED — Used General Radio Equip. GR 727 VTVM; 583 output meter; 1931-A and 731A AM monitors. State condition and price. D. W. Churchill, 64 N. Main St., Rutland, Vt.

WANTED — Good RCA 5TP4 Projection Kinescope, for reasonable fee. T. J. Ferus, 48 Hawthorne St., Lowell, Mass.

FOR SALE — Two Globe CB100 transceivers with CH. 11 xtals, Ground Plane and 102" whip antenna, used 1 month. Complete, $200. K. T. Baldridge, Box 62, Irvington, Ill.

FOR SALE — In good condition, Precision E-200; Heath: signal tracer, condenser checker, and high voltage probe; German made 12" Fiodex Hi-Fi speaker. Myles Suffecool, 418 Belden Ave. N.E., Canton 4, Ohio.

FOR SALE — Receiving and transmitting tubes, test gear, electronic parts. Best possible prices. Send stamped envelope for list. Need instruction manual for 3" scope RCA TMV-122D. Eugene Carey, Rockaway Valley Rd., Box 132, Boonton, N. J.

WANT — All special-purpose tubes and commercial test equipment. D. Kantor, 550 Fifth Ave., New York, N. Y.

SELL OR TRADE — Kodak B2 film developing tank, takes 3½" width, no dark room required; unused 2C43 tubes; RCA 918 photocells; 750 w. T-12 projection lamps. Need test equipment. J. Teltsch, P. O. Box 82, West Farms Sta., Bronx 60, N. Y.

WANTED — Working tape recorder for under $35. State make, model and price. Ron Aldsheimer, 111 Main St., Waterville, N. Y.

FOR SALE — Citizens Band users: add squelch action to your Heathkit CB-1 and other regenerative transceivers. Reduce annoying hiss. Completely wired unit, $2. Guaranteed. Oliver A. Zucco, Box 718, Canaan, Conn.

FOR SALE — AF54 Elmac mobile transmitter with push-to-talk mike, $60; Master mobile whip with center loading all-band coil and extension, $12; Gonset super six converter, $20. All 12 v. All for $85. T. K. Brown, 1111 Chenango St., Binghamton, N. Y.

FOR SALE — Ameco lowpass filter LN-2 with coax fittings, $3. Louis Tonik, 1204 Passmore St., Philadelphia 11, Pa.

FOR SALE — 100 w. rack and panel (813) home brew rig; VFO; 2 element 2 band beam with Alliance Rotator; Heath Mohawk receiver and unused speaker, with manuals. Mort Rosen, 2075 East 65th St., Brooklyn 34, N. Y.

WANTED — 3 Transceivers 27.43 Mc. 60 w. narrow band; 12 v. alternator, also need 4 citizen band transceivers. Cash waiting if priced right. S. Krzak, 65 Main St., Pawtucket, R. I.

TRADE — Shopsmith ¾ hp motor accessories for transmitter Viking or Apache class having VFO. Metropolitan N. Y. area. Sam Fried, 53 Warren St., Clifton, N. J.

WANTED — AC powered UHF Aircraft frequency receiver 108-136 Mc. R. W. Spradling, 651 Saratoga Dr., Chicago Heights, Ill.

FOR SALE — Hickok 470 VTVM, $35, in very good condition. Paul Richter, 4235 Wickham Ave., Bronx, N. Y.

FOR SALE — Sams Photofacts; Hickok 680 UHF marker generator with crystals. Also key machine to swap. Moser, Rt. 1, Lewisburg, Pa.

FOR SALE — Dumont 165 3" scope with manual; Link 30-40 Mc. FM receiver 6 v. less power supply with control head; Simpson 260 multimeter; TS-170; ARN-5. Interested in BC-221. George A. Kee, 32 Constitution Blvd., New Castle, Del.

WANT TO BUY — Table model Zenith radio, A-B-C bands, does not have to be in tip-top condition. Fred Simonian, 25 Smith St., Lynn, Mass.

WANTED — Mobile short-wave converter, all frequencies for 12 v. operation, must be in like new condition. Seymour Weiss, 1535 Undercliff Ave., Bronx 53, N. Y.

SELL OR TRADE — Bell & Howell 16mm sound movie projector, heavy duty school type, for good late model communication receiver, or best offer over $200. O. L. Bassette, 31 Main, Danielson, Conn.

WANT — Tube layout of Constellation 1126 radio; Supreme radio manuals; Zenith 6S597 radio power transformer. R. M. Massey, 423 Monroe St., Philadelphia 47, Pa.

SWAP — CB transceiver and other items to swap for LM or BC221 freq. meter. Thomas A. Hughes, 116 Bouchard Ave., Dracut, Mass.

CASH OR TRADE — 10" TV sets in working cond. State cond. and what is wanted for trade. R. E. Bridges, 217 Lineberg St., Shelby, N. C.

FOR SALE — NRI 56 oscilloscope, wide band, can be used on black and white or color TV, all probes included, $120. Perfect operating condition. L. E. Texter, Box 179, Pavilion, N. Y.

TRADE — Geiger counter, 300 vols. Radio-TV News, Electronic, Service and Popular Electronics. What have you? G. E. Stowers, 2020 East 48 Terr., Kansas City, Mo.

SWAP — 20 albums of world's greatest operas by famous operatic artists, etc., 78 rpm. 12 inch. Want Transoceanic radio and short wave receiver, Leica camera, or tape recorder. V. Lombardo, 1685 Lafayette Ave., Bronx 72, N. Y.

SELL OR TRADE — 1917 quarters without three stars under the eagle for old used small radio sets. These coins are very scarce. R. E. Bridges, 217 Lineberg St., Shelby, N. C.

SELL OR TRADE — All like new: Eico VTVM; 5" scope; 6-12 v. batt. eliminator; deluxe signal tracer; CRT tester; Seco GCT tube tester; Superior signal gen.; tubes, etc. Want old U. S. coins, tape deck, photography equip. Send offer. Bill C. Wall, 36576 Buetke Dr., Newark, Calif.

FOR SALE — Philco 7050 tube tester, $20; Sprague Kwik-Test Capacitor Checker, $20; Standard Coil Cascade Tuner, $8. Thomas Julian, 11 Gere Pl., Fanwood, N. J.

FOR SALE — Heathkit sweep marker gen., TS-4A, $45, sig. generator SG-8, $19.50; Precise Gm, Em tube tester model III, adapter, with extra carrying case, $110; Simpson In-circuit Capacometer, model 383A, $82. Louis W. Cirr, 240-16 Weller Ave., Rosedale 22, N. Y.

WANT — Norelco stereo tape recorder, EL 3516. Recorder requiring moderate repairs acceptable. State price and cond. A. Stellerman, 229 Snediker Ave., Brooklyn 7, N. Y.

TRADE — TV and radio test equip., parts, cap. res., tubes. Want rifles, any kind and .22 cal. ammo. Walter Erb, 3064 "A" St., Philadelphia 34, Pa.

WANTED — Does anyone have a Hallicrafter S-75-R, combination rcvr. and CW xmitter in reasonable condition? Wesley W. Brogan, 306 Bethlehem Pike, Ambler, Pa.

WANTED — Superior 82A tube tester. Give age, condition and price. John L. Karg, 488 E. McMurray Road, Canonsburg, Pa.

WANTED — 6B5 or 6N6 tubes. State price and number. M. A. Porter, 4930 No. Pulaski Rd., Chicago 30, Ill.

FOR SALE — Sico tube tester, TW-11 in very good condition, $22 postpaid. E. Magnano, Rt. 1, Box 100, Durham, Conn.

FOR SALE — Regency CBM-27 CB transceiver for 12 v. mobile use. Slightly used, very good condition. No reasonable offer refused. J. Leonard Herron, 1245 S. Wabash Ave., Chicago 5, Ill.

FOR SALE — Bell T223 tape deck with carrying case, 2 and 4 track, 7½ and 3¾ speeds, record and playback, like new, $169. Jerry Dachs, 1718 Grand Ave., Bronx 53, N. Y.

SELL OR TRADE — Radion field strength meter, battery operated, fair condition, best offer over $25 or trade. James W. Grimmette, Bruno 4, W. Va.

WANTED — Books, magazines, instruction books, articles, etc., on electronic subjects. Send list to Robert R. Clark, 109-28 142nd St., Jamaica, N. Y.

WANTED — Information on bringing Army surplus tube tester I-177-A up to date. Also manuals or other information on same. Walter Shaltes, 240 S. Prospect St., Connellsville, Pa.

FOR SALE — Heathkit TS-4A TV alignment generator; Heathkit 0-12 lab. oscilloscope with instruction manuals. Mint condition. Best offer. J. C. Kelly, 369 Elmora Ave., Elizabeth 3, N. J.

SELL OR SWAP — RCA BP-10 with carrying case; 12" Utah PM speaker in wood-leather baffle, with matching trans.; Terman's "Radio Engineering," '32; W.E. pickups. Need ham accessories. I. Diamond, 130 Walnut St., Paterson 2, N. J.

RADIO HISTORY — Looking for correspondents interested in vacuum tube, receiver and radio broadcast station history. Have compiled much data on these subjects and will buy old radio items. William D. Slade, P.O. Box 369, Tabor, N. J.

SELL OR TRADE — 12 TV sets, trade-ins, all for only $100. Hillcrest TV Servicenter, R. D. 2, East Chatham, N. Y.

FOR SALE — Mallory 557 vibra-pack, 150 MA at 400 v. DC, in perfect cond., $25. Ross Radio & TV, 220 Bradford Ave., Fall River, Mass.

TRADE — DeVry Radio - TV Electronics course and parts for good saddle or plating equipment. Art Lowe, Farmersburg, Ind.

SELL OR SWAP — For good lathe or machine shop equipment: set of Riders radio manuals, Vol. 1-5 combined, Vols. 6 thru 17, very good condition; two doz. tuners removed from old TV sets, assortment power transformers, yokes, etc., from older sets. C. R. Maduell, Jr., 621 Homedale Ave., New Orleans 24, La.

WANTED — RCA Television Pict-O-Guide, Vols. I and II. State price. LePage, 1202 Tower Petroleum Bldg., Dallas 1, Texas.

FOR SALE — Mobile radio parts, vibrators, dynamotor, power paks, cables, control heads, etc. Write for free list. C. N. Vallette, 1026 Claire Ave., Huntington Valley, Pa.

SELL OR SWAP — Test equipment, Riders manuals, tubes and parts, cost over $1500. Will sell for half or trade for car, printing equipment, etc. Howard Crownover, 3610 Winona Way, North Highlands, Calif.

BUSINESS FOR SALE — Radio-TV Repair Shop, established 15 years, $40 month rent including living quarters. For details, write Bernie's TV, 42 Caroline St., Saratoga Springs, N. Y.

SELL OR TRADE — Radio and TV tubes, swap lists; 3212 Triplett tube tester, $30; Mallory UHF converter, $10; boosters, $4.50. Andrews, 139 E. Union Blvd., Bethlehem, Pa.

URGENTLY WANTED — Diagrams, alignment information, or service manual for "Echophone Commercial" receiver. No markings anywhere on chassis to identify manufacturer or date. Please advise. Al Lacell, Aeradio Station, Graham, Ontario, Canada.

FOR SALE — Lettine 240 phone-CW transmitter, with antenna tuner, coils, Johnson Lo-pass, Shure 707A xtal mike and stand, J-38 key, xtals, completely de-TVI'd. Very good condition. Dubov, 287 Linden Blvd., Brooklyn 26, N. Y.

WANT — Used and repairable test equip., for low cash price or offer. P. J. Vogel, 3328 Caroline St., St. Louis 4, Mo.

SELL — GE GC-7 stereo cartridge, new diamond, $15; Theremin, $20; home-built intercom, incl. remote Hi-Fi speaker, $5; Mallory UHF converter, $20. Dan Talbot, 2315 3rd Ave., Scottsbluff, Neb.

WANTED — Instruction manual on Signal Corps power unit PE-75-U. Jeff D. Whitaker, Pattison, Miss.

FOR SALE — NRI Radio and TV home study course, complete with kits, never used, $50. Samuel D. Helsel, R.D. Box 222-A, Roaring Spring, Pa.

WANTED — Schematic and/or instruction manual for 3" Triumph 830 oscillograph wobbulator. Anthony M. Gates, 2216 Gough St., Baltimore 31, Md.

SELL OR SWAP — Webster Electronic wire recorder, with mike and foot switch, good operating cond., $65, or trade for any good 50 watt or larger CW transmitter. Jack Leishman, 206 South Bailey St., Cheboygan, Mich.

SWAP — BC-625-A, 80 w., 2 mtr. xmtr., without power supply; DX-40, with blower; HB plate mod. for DX-40 with separate power supply; Heath VFO with separate HB regulated power supply; dual xtal mike, stand and cable; LP filter; Heath AM-CW break-in- unit with visual monitor. Norm Gignac, 45 No. Elliott Pl., Brooklyn 5, N. Y.

SELL OR SWAP — Precision CR-30 CRT tester with 110 adapter; Precision tube tester, like new cond. Write for details. Brian Chin, 22 Mulberry St., New York 13, N. Y.

FOR SALE — Unused Granco CTU UHF TV converter; Ansco PD 16 folding camera; Meissner 13 tube comm. rcvr.; Simpson 215 VOM; Eicor 15 v. DC gas gen. Best offer. R. H. Ives, Rt. 2, Box 32, Lynnhaven, Va.

FOR SALE — BC221, A-1 shape, with reg. power supply, original calibration chart. Best offer. Also Johnson Signal Sentry, $12. Want Victor Talking Machine metal or fiber horn and crank. F. A. Nichols, 720 E. Eldorado, Appleton, Wis.

FOR SALE — Heath 5" 0-6 oscilloscope, very good operating cond. with Heath modifications, $15 plus shipping. Extra 5BP1 tube, $1. Norman Wehrli, Box 336, Andrews, Texas.

FOR SALE — 30 w. McIntosh MC-30, and 60 w. Custon Fisher 260 amplifiers. Fisher is all riode with four 6A3 tubes in push-pull parallel output. Both like new, $100 each. B. E. Adams, 9441 Pickford Pl., St. Louis 36, Mo

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FOR SALE — New copies of Electronic Animal Training. Schematics and diagrams of remote, wire, and timer controlled shocking devices, $2 as marked, but $1 to Capacitor readers. Ed Whit, Box 66, Morenci, Ariz.

FOR SALE — RCA Rider chanalyst model 162, all probes, instruction manual, first class condition, $50 plus express charges. John McHocko, 205 S. 11 St., Easton, Pa.

WANTED — Record head new or used for 11A55FF Dukane tape recorders; used turning lathe such as Craftsman 80; used cheap outboard motor, about 15 hp. State price, or have used TV sets to trade. Wolf's Radio & TV, Box 415, Wishek, N. Dak.

FOR SALE — Junior Bovie electro-surgical and diathermy unit (without electrodes) in good cond.; Admiral 10" TV; RCA table model 10" TV. Both complete with tubes and working. Make offer. Anthony Schultz, 49-15 Skillman Ave., Woodside 77, N. Y.

WANTED — Cabinet for broadcast radio, Theta, Model 1000. R. H. Decker, 3441 Millrich Ave., Cincinnati 11, Ohio.

WANTED — TG34 keyer with set of tapes. State price and condition. A. Molby, 909 13 Ave. N.E., Brainerd, Minn.

SELL OR TRADE — BC-348R converted to 110 v. AC, $30; Club Saver 2-meter transceiver with 110 v. supply, $15. You pay postage. C. E. Gustafson, 302 S. 16th St., Chesterton, Ind.

FOR SALE — Crystals for 2-80 meters, 25c each, send for list of frequencies; Stancor power xfmr 1200 VCT plus filament windings, $4.75 each; 416B tubes, $4; 10 meter KW coil and jack bar, $2. Ronald E. White, 210 Alden Rd., Hayward, Calif.

FOR SALE — Tube tester, model 247, Moss Elec. Co., $20; 7" Motorola TV, $20; 15mm Keystone movie camera, $25; NRI Radio-TV course, $25. Robt. F. Steuding, R. 3, Box 44, Kingston, N. Y.

FOR SALE — Leece-Neville 5370-GB6 alternator, 14 v., 50 amp., complete with rectifier and regulator, $100. KXOL Radio, 3004 W. Lancaster, Fort Worth, Tex.

FOR SALE — Heath 25 w. amplifier with separate pre-amp.; Hallicrafters short-wave receiver; Garrard RC 88 changer with Electrovoice stereo cartridge; Jackson 5" CRO 3" scope. Want good 16mm camera. Albert Chonka, 816 Richford St., Duquesne, Pa.

FOR SALE — Two 7" Sylvania scopes, $50 each; one 5" Sylvania scope, $50. Al Ollick, 904 23rd St., Union City, N. J.

FOR SALE — CIRE course including TV, 30 lbs., $25 plus ½ postage. M. J. Wagner, 1403 Taylor Ave., Baltimore, Md.

FOR SALE OR TRADE — Sencore circuit tester, like new, AC or DC. Edwin A. Fensch, 474 Parkview St., Mansfield, Ohio.

SELL OR SWAP — Kodak Signet 35 camera, good cond., with flash and case. Want Heath SWR bridge with manual. Arthur B. Windsor, 702 Adams St., Plymouth, Mich.

FOR SALE — 2 Knight citizens band transceivers C-11, one built, one in kit, 6-12 v. DC power supply, mobile mounting bracket, mobile antenna, fixed station antenna. Must sell. Best offer. B. J. Plunket, Jr., 1610 21st Ave., Altoona, Pa.

FOR SALE — Heathkit DX-35 transmitter with 3 crystals; Heath AR-3 communications receiver with QF-1 "Q" Multiplier, all for $75. Herbert J. Anderegg, 451 Highland Ave., Orange, N. J.

CASH — For new obsolete receiving tubes: 12K7, 6A8, 75, 25B8, etc. (in lot). Must be low priced. Send list. Ben Mueller, 6458 Nash Rd., N. Tonawanda, N. Y.

FOR SALE — Eico 460K scope, completely wired with probes and manual, $90; RCA Voltomist with manual, $50. Both for $125. John Fisher, 1051 Main St., Hellertown, Pa.

NEED — Lab. type VTVM audio signal generator, oscilloscope, calibrated mike. Have TV signal gens., sweep gens., Hi-Fi base reflex cabinets, like new, amateur equipment, Ira B. Perelle, 590 Tuckahoe Rd., Yonkers, N. Y.

FOR SALE — Heathkit TV alignment generator, wired, calibrated, in very good condition. Hickok CRT-1 picture tube test adaptor. Best offer plus shipping. S. J. Stansfield, Box 471, Leslie, Mich.

C-D features the NEW COMPLETE line of Communication Vibrators

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Here is everything needed for complete service on communication vibrator replacements! Engineered to rigid U.S. Gov't specifications, these new C-D Vibrators outlast them all . . . out-perform others and give you the RIGHT vibrator for EACH application!

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CAT. No. 6 volt *	CAT. No. 6/12 volt †
5715	6715
5718	6718
5721	6721
5722	6722
5725	6725
5805	6805
5820	6820
5821	6821
5822	6822
5824	6824

Use a 6 v. vibrator for 6 v. operation and a 12 v. vibrator for 12 v. operation for Maximum Vibrator Life

* OR, for 6 v. service in 6/12 equipment
† OR, for 12 v. service in 6/12 equipment

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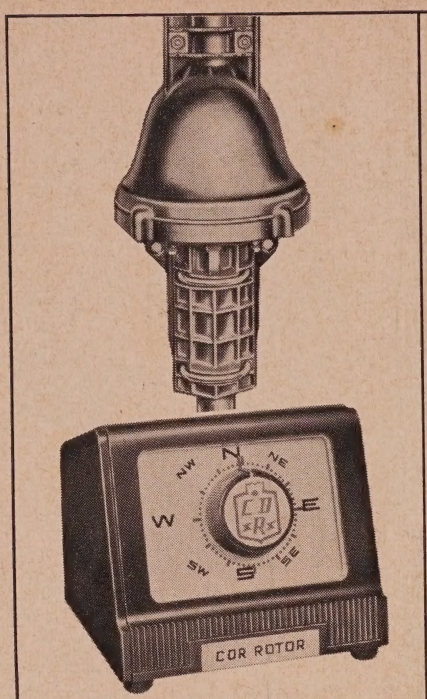
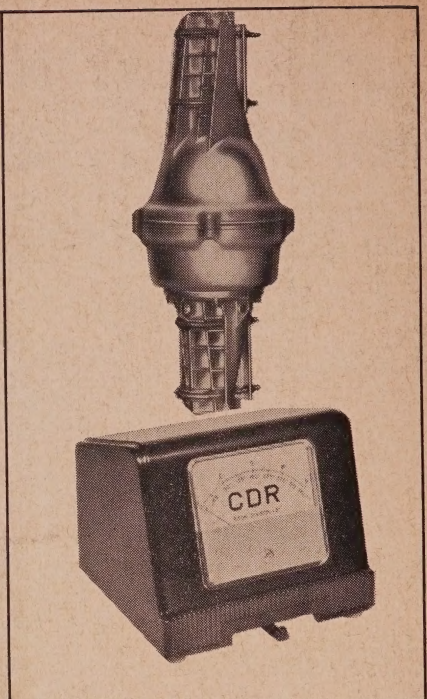
Cornell-Dubilier Vibrators

FOR AUTO RADIOS
INDUSTRIAL, MARINE AND RAILROAD CONVERTERS





FOR TV FOR HAMS

CDR ROTORS

The same superlative engineering standards set for CD capacitors are followed in the manufacture of our CDR Rotors. Wherever you use or install a CDR TV Rotor—you'll like the immediate improvement in picture strength and clarity. But don't use a TV Rotor if you're a Ham. You need the extra heavy-duty model "HAM-M"—designed especially for Hams by HAMS. See these and other CDR Rotors at your Cornell-Dubilier distributor.

CDE **CORNELL-DUBILIER**
ROTORS

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